**3.2 – Balancing Chemical Reactions**

**Law of Conservation of Mass**

* Matter cannot be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but merely changed, converted or rearranged
* In a chemical reaction, the total mass of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is equal to that of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ entering the reaction – atoms are not created or destroyed, but simply rearranged.
* Therefore, in a chemical reaction, **the chemical formula must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – each side of the equation must have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**Law of Conservation of Energy**

* Similar to the previous law – energy is not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but simply \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* For this reason, sometimes we must represent \_\_\_\_\_\_\_\_\_\_\_ in our chemical equations.
* For our purposes, we can simply write “\_\_\_\_\_\_\_\_\_\_\_”. The location will depend on the type of reaction.
* **Exothermic** – heat is written on the \_\_\_\_\_\_\_\_\_\_\_\_ side.
* **Endothermic** – heat is written on the \_\_\_\_\_\_\_\_\_\_\_\_ side. For these, heat can also be written above the reaction arrow as “heat” or as “∆”.

**Balancing Reactions!**

* Balancing must be done with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These are numbers that will appear immediately before the reactant or product. For example, \_\_\_\_\_\_\_ could become \_\_\_\_\_\_\_\_.
* You can change coefficients to balance, but \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_! For example, H2O could **never** be turned into H2O2 in an attempt to balance.

**Tips for Balancing – An Example…**

* Begin with atoms that occur only \_\_\_\_\_\_\_\_\_\_ on each side of the arrow. For example:

C3H8 + O2 🡪 CO2 + H2O

* It would be very difficult to start with oxygen, since it appears in one reactant, and two products. Use C or H first.

Starting with carbon:

C3H8 + O2 🡪 \_\_ CO2 + H2O

Now each side has 3 carbon atoms.

There are 8 hydrogens on one side, and just 2 on the other. So…..

C3H8 + O2 🡪 \_\_\_CO2 + \_\_\_H2O

Now carbon and hydrogen both have even numbers.

Oxygen is left. There are 2 oxygen on the left, and 10 on the right. So…

C3H8 + \_\_\_O2 🡪 \_\_\_CO2 + \_\_\_H2O

Now, our reaction is completely balanced.

3 carbon = 3 carbon

8 hydrogen = 8 hydrogen

10 oxygen = 10 oxygen

* For the finished, balanced equation, include states. Our example would look like this:

C3H8(g) + 5O2(g) 🡪 3CO2(g) + 4H2O(l)

It might help to draw a small table when balancing. In our example, it could have looked like this:

|  |  |  |
| --- | --- | --- |
|  | Reactants | Products |
| C |  |  |
| H |  |  |
| O |  |  |

From here, you can change each number in the table as you work through the problem.

* **Balancing is a skill that takes practice! You may easily understand the concept of it, but in order to become good at it, you will need to spend some time working at it.**
* **Let’s get to it then!**